Problem Based Learning and Entrepreneurship

A Guide for Students Entering Problem Based and Entrepreneurial Project Work

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PROBLEM BASED LEARNING AND ENTREPRENEURSHIP

A GUIDE FOR STUDENTS ENTERING PROBLEM BASED AND ENTREPRENEURIAL PROJECT WORK

AALBORG UNIVERSITET
AALBORG ESBJERG KØBENHAVN

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PREFACE

If you are reading this guide, you are probably interested in start-ups and/or being a part of an entrepreneurial project. Maybe you have approached SEA (Supporting Entrepreneurship, AAU Innovation) or a comparable institution with an idea. It might be an idea of a solution or a business, an idea of a how you can contribute to solve a specific problem, or maybe both. Much has been written on how to foster creativity for idea creation, whereas in this guide we will be more concerned about the entrepreneurial process of transferring these ideas of yours to value creating actions. An idea is "just" an idea as it by nature lacks grounding in real-life situations, but with a PBL approach ideas are linked to real-life problems. In this way, the potential of the idea is legitimised and the value creation becomes real through a problem based and entrepreneurial project. Real-life problems, experiences by real-life actors and real-life societal contexts are the foundation of problem based learning (PBL).

The problem based learning approach includes the idea as a specific problem type, but it underlines the need for in-depth understanding of the current situation and the actual need for change. Furthermore, as ideas have to be adapted to the context in order to create value for someone in a given time and space, it can be argued that entrepreneurial projects are problems based in nature. But in practice, as noted by the SEA team of incubators, it is far from easy to systematically structure entrepreneurial project work.

In this guide, we will help you to do exactly that, by using the experiences with facilitation of entrepreneurial PBL from SEA incubators and the experiences with PBL modelling at the Aalborg Centre for Problem Based Learning in Engineering and Science and Sustainability under the auspices of UNESCO (UCPBL).

We would like to thank the SEA incubator team for their inputs. More specifically, we thank Liv Holm Andersen, Ivan Butler, Marie Fallgaard, Rasmus Hedegaard, Heidi Nørgaard Jensen, Lasse Jensen, Line Uggerly Jørgensen, Jacob Lundberg and Jesper Helleskov Sørensen for their valuable inputs on incubator facilitation practice. We would also like to thank the head of UCPBL, Professor Anette Kolmos, for her comments and inputs for the guide.

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Aalborg, June 2020
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INTRODUCTION

In 2017, SEA (Supporting Entrepreneurship, AAU Innovation) took up the challenge to define and model entrepreneurial PBL. This was done in close collaboration with teachers from different faculties at Aalborg University (see Strand et al., 2019).

Entrepreneurial PBL is defined as:
"a study approach where students through iterative learning processes develop an entrepreneurial mindset in a problem oriented project work. Wondering is the driving force, where theoretical, methodological and empirical knowledge is transferred to new value creation through targeted action based on an ethical foundation and in interplay with relevant actors" (Strand et al., 2019).

Furthermore, together with the art of creating, uncertainty and management of iterative processes were emphasised as key characteristics for the entrepreneurial project. The iterations in the entrepreneurial process are pictured as a spiral moving though different phases from understanding the problem to value creation (see Figure 2) by making choices in regard to methods and theories, exploring assumptions and making experiments. From a PBL perspective, the construction and the ongoing reconstruction of the way the problem is understood and framed are fundamental.

As you can see by the model in Figure 1, PBL and entrepreneurship are intertwined in the spiral of learning, and the PBL dimension focuses on understanding the problem and eventually new solutions, thereby combining PBL and an entrepreneurial mindset. The purpose of this guide is to help you to merge the PBL and entrepreneurial perspectives in practice by presenting a five-step model (see Figure 2) for gradually improving the perspective and problem understanding in the entrepreneurial PBL process.

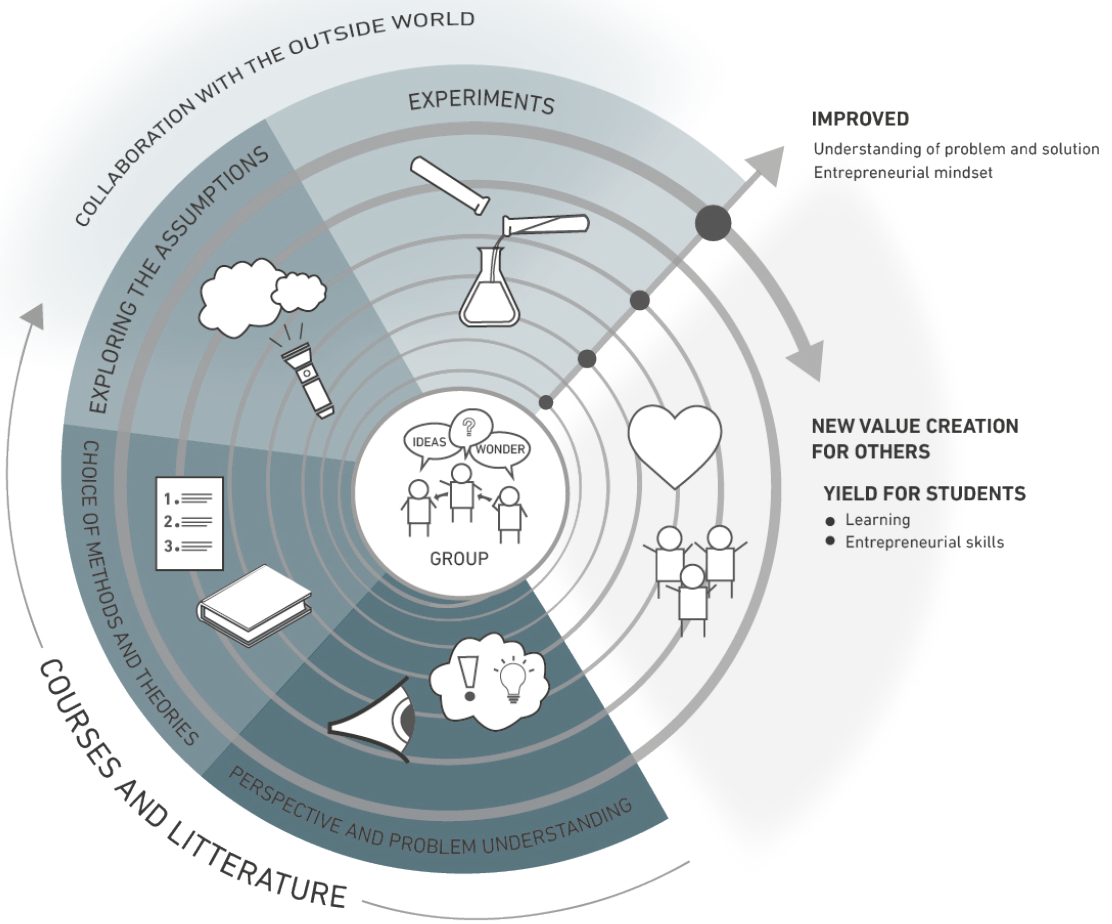


Figure 1: Model for the entrepreneurial PBL process (Strand et al., 2019:12).

The five-step model is focused on how you make a solid problem design to guide not just one problem solving process but a problem solving process that more likely will create value.

MANAGING THE PROBLEM DESIGN PROCESS

1. INITIATION IDEA

What characterises the idea?
Product - service - business concept
Type of innovation: Incrementel or more radical

3. PROBLEM-ANALYSIS

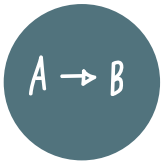
What are the PAINs & GAINs for who, where, when, and how - what is the potentiel for value creation (the why)

5. PROBLEM-FORMULATION

Update the initiating problem-formulation to be more precise
Formulate questions that initiates actions to create value
Clarify the flow of actions

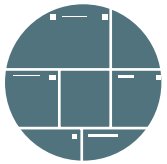
2. INITIATING PROBLEM

State the problem, understood as a discrepancy between an actual state and the vision embedded in the idea.
What should be analysed to clarify the current PAINs and potential GAINs?



4. PROBLEM-VALIDATION AND SCOPING

Conclusion of the problem analysis is validated with external partners
Based on the validated model a business model is prepared (focus on how)



1 CLARIFYING THE INITIATING IDEA

We take as a fundamental premise that even though you might have an idea of your own, you cannot create value for others alone. For this simple reason, you have to be able to provide insight for others to understand the idea, including how and under which premises the idea has been formed and how mature the idea is. Based on the inputs from the incubator team in the SEA case, some of the very first questions to unfold the idea therefore include a rather comprehensive list of questions, such as:

- What is the idea — in short?
- Where does the idea come from — what have been the sources of inspiration?
- What are the dreams/visions/ intentions related to this particular idea? What are the dreams/visions/intentions in being a part of an entrepreneurial project?
- What type of innovation are we talking about — incremental or more radical?
- Who are the persons carrying the idea — their competence profile, including prior experiences with entrepreneurial projects?
- Have you worked together as a team before, and in that case how will you characterise the team roles?
- Why have you chosen to follow this particular idea?
- How do you think you can contribute to value creation based on this idea?
- How far are you in the process, e.g. who have you been in contact with to discuss the idea and with what outcome?
- What are the learning ambitions of this potential entrepreneurial project, including eventual relations to study programmes?
- What resources are you willing to invest in this entrepreneurial project?
- What do you expect of differences in this entrepreneurial project compared to other projects you have been engaged in?

The last question could initiate a discussion of what can be expected when working on an entrepreneurial project, including also considerations to potential new areas for personal developments. It could be handling a project with a high degree of uncertainty, creating knowledge networks, ensuring market potential, etc.

At the end of this initiating phase, you should be able to pitch your idea as a kind of idea "status" that will make it possible for external panellist to provide inputs. As SEA incubators noted, it is important that you can describe your idea in different ways, as you will meet diverse target groups with different languages, different understandings, etc. Besides presenting your idea, you should be able to present your team by clarifying the code of conduct for team collaboration. As the entrepreneurial PBL process evolves, you might invite others in, and a basic condition for a smooth transition is that you can be explicit about the team culture and work practices — and being explicit and concrete also makes sure that you actually agree on what it actually takes to make a high performance team in your case.

2 | CLARIFYING THE INITIATING PROBLEM

In the next stage, you can start elaborating on the problem area related to the idea. It might be tempting to rush to the design of a product or outline a business model, but according to the SEA incubators, there is a high risk that this will end up making a product that addresses a pseudo-problem. A pseudo-problem can be a problem which is not relevant to many (besides yourself) or is of so limited relevance that people are not ready to invest in your solution to actually get the problem solved. The key is therefore to use the appropriate amount of time to get an understanding of the problem that you are trying to match up with your idea of a potential solution. A problem can be understood as a discrepancy between an actual state and a vision of a changed state.

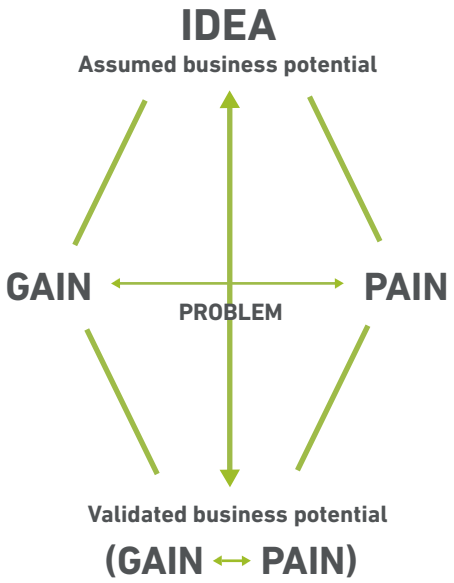


Figure 3: The problem areas expanded by the interrelation between the potential gains and pains of a particular idea. The vertical arrow furthermore illustrates the validation process.

A problem can be understood as a discrepancy between an actual state and a vision of a changed state. An idea, on the other hand, is typically a means to provide some kind of potential for change. Let us take an example. Three students from media technology have the idea of an intelligent walker to assist people, especially the elderly, with walking disabilities. The idea is to adjust the traditional walker to user needs other than just walking, taking into considering that the user in many situations has both hands occupied to handle the walker. However, as such, there are many assumptions embedded in this idea, e.g. that people with walking disabilities would in fact value the integration of more intelligent technology and that a walker is in fact the most appropriate product group to build on.To get an overview of the so-called problem area for a start, the problem triangle has been used in engineering and science projects at Aalborg University to distinguishing three general types of problems (see Figure 3 for overview):

- Problems in a positive sense: There is a potential which is not yet realised. The incubators referred to this kind of problems as POTENTIAL GAINS (using the conceptual framework from business modelling) – where the challenge is to find a situation where the potential can be realised and create value.
- Problem in a negative sense: There is an unsatisfactory situation where somebody express a need for change on behalf of themselves or others. The incubators referred to this kind of problems as PAINS – where the challenge is to find a solution to address the needs.
- Problems in a neutral sense: There is a situation where the potentials and risks are not yet clear. The incubators referred to this kind of problems as matters of VALIDATION – which calls for an in-depth analysis of both the needs and the potential solutions.

In this initiating process, it is important to be aware that the purpose is to get an overview based on a brainstorm of PAINs and GAINs, which mutually inform each other as they emerge. In regard to the idea of an intelligent walker, potential pains could be combined disabilities, e.g. having a memory disorder in addition to a walking disability, not being aware of potentially harming body postures, not being able to handle items other than the walker, etc. The gains could be increased quality of life, increased safety, getting another item to quantify oneself, getting easy access to information while walking, etc. Brainstorms, internet searches and, if possible, getting a sense of real-life practice through explorative observations can be used to gradually expand and qualify the richness of the problem area.

As noted by SEA incubators, it is important that you quickly expand your scope in the initial phases. But at the same time, you also have to know when to stop to prioritise and focus on limiting the problem area to enable a more in-depth analysis of the problem. A way to clarify this limitation is by formulating an initial problem statement. In the example of the intelligent walker, an initial problem statement could be:

Using a walker is for many people a way to feel secure when going for a walk. Initial observations, however, have shown that handling a walker can limit the access to other tangible items, which can come to be used in everyday life errands, e.g. handling the mobile phone, locate yourself on a map, or handling your shopping list or your credit card for everyday shopping. Based on this initial hypothetical problem, the following question will guide the further problem analysis:

Which potentials would there be in making an interactive walker that can assist elderly in ways other than walking?

In this way, the group narrows down the problem area and points to further analysis and validation within a more limited scope — although the problem statement still opens up new considerations. You might even formulate sub-questions to further direct your problem analysis. In any case, the overall question and the sub-questions are not fixed and are typically changed as insights follow from the problem analysis.

However, continuous attention to the current initial problem formulation offers the opportunity for the group to have an explicitly formulated and shared focus.

3 | PROBLEM ANALYSIS

In the problem analysis, you will deconstruct the problem and seek in-depth understanding of what constitutes the problem. Holgaard et al. (2017) propose that students use the 5W1H model and, more specifically, the following questions (Holgaard et al., 2017: 1081):

- Why — a matter of relevance: Why is this problem occurring? Why is it a relevant problem? What will happen if this problem is not solved? What are the symptoms? What are the impacts?
- What — a matter of conceptualisation: What concepts do I have to know more about to be able to understand the problem?
- Who — picturing stakeholders: Who is causing the problem? Who says this is a problem? Who is impacted by this problem? Who has an influence on the problem?
- Where — referring to place, site, and context: Where does this problem occur? Where does this problem have an impact?
- When — stressing the time perspective: When does this problem occur? What is the state of the art to address this problem? When did this problem first begin to occur?
- How — pointing towards possible solutions: How are people currently handling the problem? How can other solutions help to solve this problem? How important is the problem to the stakeholders? What new technology needs to be developed to solve this problem? What is the market potential for the solution in mind?

In all cases, it is important to realise that you are not a part of the target groups yourself — in other words, you cannot be your own source. This is a rather traditional fact when doing scientific work, but in the case of an entrepreneurial project, it can become challenging to accept. The costumer/user and their needs might already be a part of your mentally constructed idea, and in the eye of the beholder this makes perfect sense. In popular terms, you have to "kill your darling" or at least a part of how you imagined it all to be. A very practical tool to help to ensure that common sense misunderstandings are excluded is to attach references to a 5W1H diagram to support the claims. If there is no reference to a claim, then it can only be added in the problem analysis as an assumption or as an area in need for further analysis. Figure 4 provides an example of a structure to make a 1H5W diagram for problem analysis.

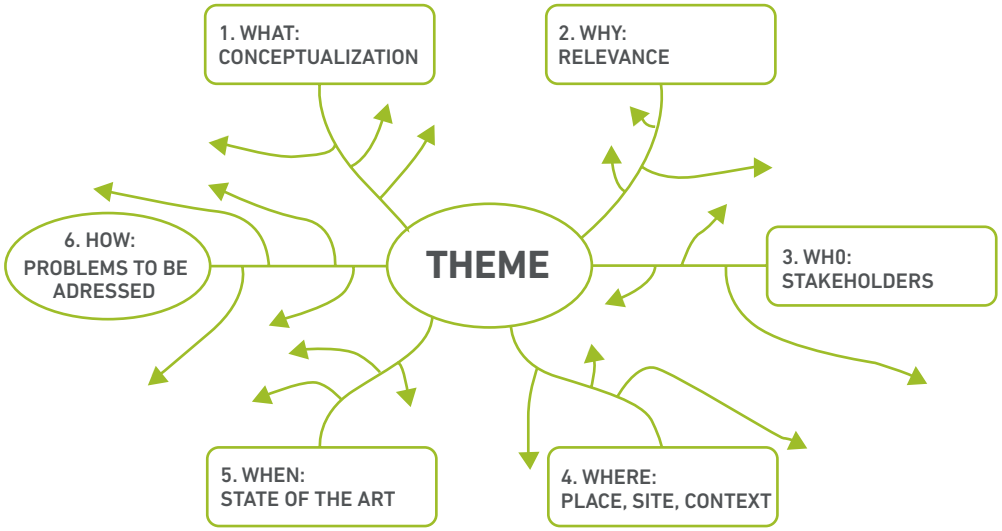


Figure 4: The 5W1H model, adapted from Holgaard et al. (2017).

4 PROBLEM VALIDATION AND SCOPING

In a typical problem based learning project, the conclusion from the problem analysis would lead to a problem formulation. However, in the entrepreneurial project, there is an explicit focus on value creation in a business context, and thereby there are two parallel processes in play — one related to the development of a product/service and one related specifically to the development of an aligned business model. The problem analysis will therefore not only lead to a problem formulation but also provide the first inputs to a business model. With reference to the Business Model Canvas (Osterwalder, 2004), the problem analysis will typically inform the business model in regard to the following:

- Value propositions: What value do we expect to deliver to the customer? Which problems are we helping to solve? Which customer needs are we satisfying?
- Customer segments: For whom are we potentially creating value for?
- Revenue streams: How do we propose to make money? Are the customer segments large enough to create a viable busi ness? Is there value? Is the value proposition strong enough to lead the customers to buy?

  It is, however, important to realise that the understanding of value propositions, customer segments and revenue streams will be expanded and revisited throughout the problem solving process.

It is, however, important to realise that the understanding of value propositions, customer segments and revenue streams will be expanded and revisited throughout the problem solving process. Furthermore, the Business Model Canvas will be elaborated in terms of the other constituting factors: key activities, key resources, key partners, customer relationships, channels, cost structure and revenue streams. An experienced and established business manager might be able to sketch out a business plan rather early in the process, whereas a start-up has to accept many black boxes and uncertainties along the way. However, the conceptual framework such as the Business Model Canvas is valuable in supporting you in asking the types of questions which are not traditionally asked when working in a problem based learning project that is not specifically focused on value creation and business development.

Nevertheless, although the initial business plan is far from complete at this point, you should not miss the opportunity to get it tested and informed by external partners. In the SEA community, you get access to external business partners to provide you with inputs for external validation, and also internal validation from local incubators and peers are arranged. This provides both internal and external validation of the business model in its early stage and, based on the experiences of the validators, a scope to develop the business model further along with the development of the product/service.

5 PROBLEM FORMULATION

Based on the problem analysis and the initial business model, you can now qualify the initial problem statement (which initiated the problem analysis) to a problem statement (which will initiate problem solving). At the same time, the problem formulation represents a delimitation of the problem area and directs the problem solving process to objectives that are within reach considering the timeframe of the problem. In this regard, there are differences between a group of students who have fixed timeframes and graduates who might not have a fixed deadline. In any case, the project organisation implies a timeframe aligned with realistic objectives and potential follow-up projects.

If we take the case of the intelligent walker, an example of a problem formulation could be the following (note that both the problem and the overall question to direct further action constitute the fundamental parts of the problem statement):

A User-Needs-in-Context Study (UNiCS) has revealed that elderly feel insecure when having to handle other items when shopping. Furthermore, the study also showed that many of the elderly aged less than 75 had experiences with IT such as iPhones and iPads. Based on this problem, the following question will guide the problem solving process:

How can an interactive walker with a plug-in iPad and an appropriate application assist the elderly while walking in a way that would enrich their shopping experience to an extent that would create a solid business case for an intelligent walker?

Yet again, sub-questions would specify the process by questions initiating both the development of the product/service, e.g. the design, implementation and test of the application, and for the entrepreneurial project the further development of the business model, e.g. a more detailed market analysis or a stakeholder analysis focused on identifying key partners. As noted before, objectives are important to clarify how far the development process has reached and where this project is aiming — yet again, it is crucial that you remember the two intertwining streams in the entrepreneurial project related to the product/service and business model.

For the team collaboration, the problem formulation stage furthermore is an appropriate time to evaluate your work practices, the established team roles, the chosen resource management scheme, etc. Also, it is a time to reflect upon the competences in the group — what can you do to contribute to the value creation process and, more importantly, what can you not do? What will you accomplish together with others in this project, and what will you save for later — why is that? How will the work in this project help to fulfil your initial learning ambitions in this entrepreneurial project? What are you looking forward to in the problem solving process — and do different preferences complement each other in this regard? What will make you stay in this project? What would make you leave? Such considerations can be important contributions to make your team develop to a high performing team, as the basic premises for such is the capacity to mutually support and commit to one another's growth and success (Katzenbach & Smith, 1993).

6 FINAL REMARKS - PROBLEM SOLVING AND BEYOND

The methods used to address the problem statement are diverse and will depend on the problem at hand. However, as a final remark, some general guidelines can be given to the problem solving process in the entrepreneurial project:

- Chose an agile project management scheme. Define core phases to structure milestones — and be sure to cover both the product/service and business model stream.
- Choose an appropriate model to structure iterations in the development process
- Make sure to revisit the problem formulation along the way — and do be not afraid to change it.
- Make sure to revisit the code of conduct for the group and the expectations and confront the issue, if things are not working at planned.

In the example of the intelligent walker, the students could use SCRUM as an overall project management scheme and V-models from the system engineering approach, e.g. to structure iterations during development of the app. They could use a step-by-step guide to develop their business model, and like in the V-model, they could use external partners to validate the development and adjust previous steps to be aligned with new developments. The group, furthermore, could agree and state this in the group contract, to revisit the problem formulation every second week for potential revision and alignment of upcoming activities. For other types of projects, e.g. finding new ways to approach autistic children, the toolbox and approach will of course be different.

Finally yet importantly, throughout the process, remember to keep in tune with the entrepreneurial mindset, and acknowledge that this mindset is not something that magically will be there when entering an entrepreneurial project — it is a learning process. Therefore, you cannot expect:

- Feeling totally relaxed when being outside your comfort zone most of the time — however, it helps that you are not there by yourself.
- Avoiding frustrations — they are the basic drivers of learning — embrace it, confront it and deal with it together.
- Ongoing success — in fact, dealing with so-called constructive failures (Kapur, 2008) is an integrated part of being entrepreneurial.
- Sticking to the plan — as Eisenhower put it, “Plans are nothing, planning is everything”.
- Doing everything by yourself — therefore do not only use the knowledge of others — use the knowledge network of others.

What you can expect, however, is to work with a different type of project than is typically a part of the ordinary curriculum. The problem based entrepreneurial project offers the opportunity to work across disciplines, to spot opportunities, to cope with ambiguity, uncertainty and risk and to improve your business abilities including the creation of business cases and the mobilisation of resources to create value. Enjoy.

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